

THE GEOLOGY OF THE SNOWY RIVER DISTRICT, EAST GIPPSLAND

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Introduction

This paper has been prepared to supplement an earlier paper by the author in this journal covering the geology of 180 square miles of the Deddick and Wulgulmerang area. In that paper, among other subjects, the stratigraphy, petrology and structural relationships of the Snowy River Volcanics were discussed in some detail. This contribution describes the results of additional reconnaissance mapping undertaken to reveal the regional stratigraphic and structural relationships of the Snowy River Volcanics. The area covered stretches from The Cobberas in the north to Murrindal in the south, a distance of 40 miles, and lies parallel to, and partly along, the Snowy River.

The mapping has been based upon field mapping by Ferguson for the Geological Survey, in which the boundaries of major formations were outlined. The work of the author has consisted principally in mapping the individual flows within the Snowy River Volcanics. The Snowy River Volcanics south of Murrindal have already been the subject of work by Teale (1920), Cochrane and Samson (1947) and Gaskin (unpublished), and correlation between these areas and the district to the north has been obtained.

Previous Work

In the earlier paper the author has discussed most of the previous work pertaining to the area covered. The reader is referred to that paper for details. The various papers mentioned will be considered when they are relevant to the context. The only one not mentioned previously is a brief report by Ferguson (1899A) on the Geological Survey of the Snowy River.

The only work of importance previously carried out in the area has been by Howitt (1876, 1878) and Ferguson (1899B).

Physiography

The physiography of the area is controlled by the differential erosion of an elevated peneplain. The peneplain, partly covered by Newer Basalt, slopes regularly down from The Cobberas (6,025 ft.) towards the south. It is in a youthful stage of dissection and the main rivers and creeks have incised gorges and steep-sided valleys.

Granitic rocks and limestones have been much less resistant to erosion than the slates and volcanics and tend to occur in topographic basins surrounded by high rugged slate and rhyodacite country. Basins of this kind in granitic rocks are found at Deddick, Suggan Buggan, Campbell's Nob and along the Buchan River. Basins in limestone country include Murrindal, Native Dog Creek and Gelantipy. Wherever volcanics and slates are dissected, great gorges and precipitous valleys are formed—e.g., Little River, Boundary Creek, and the Snowy

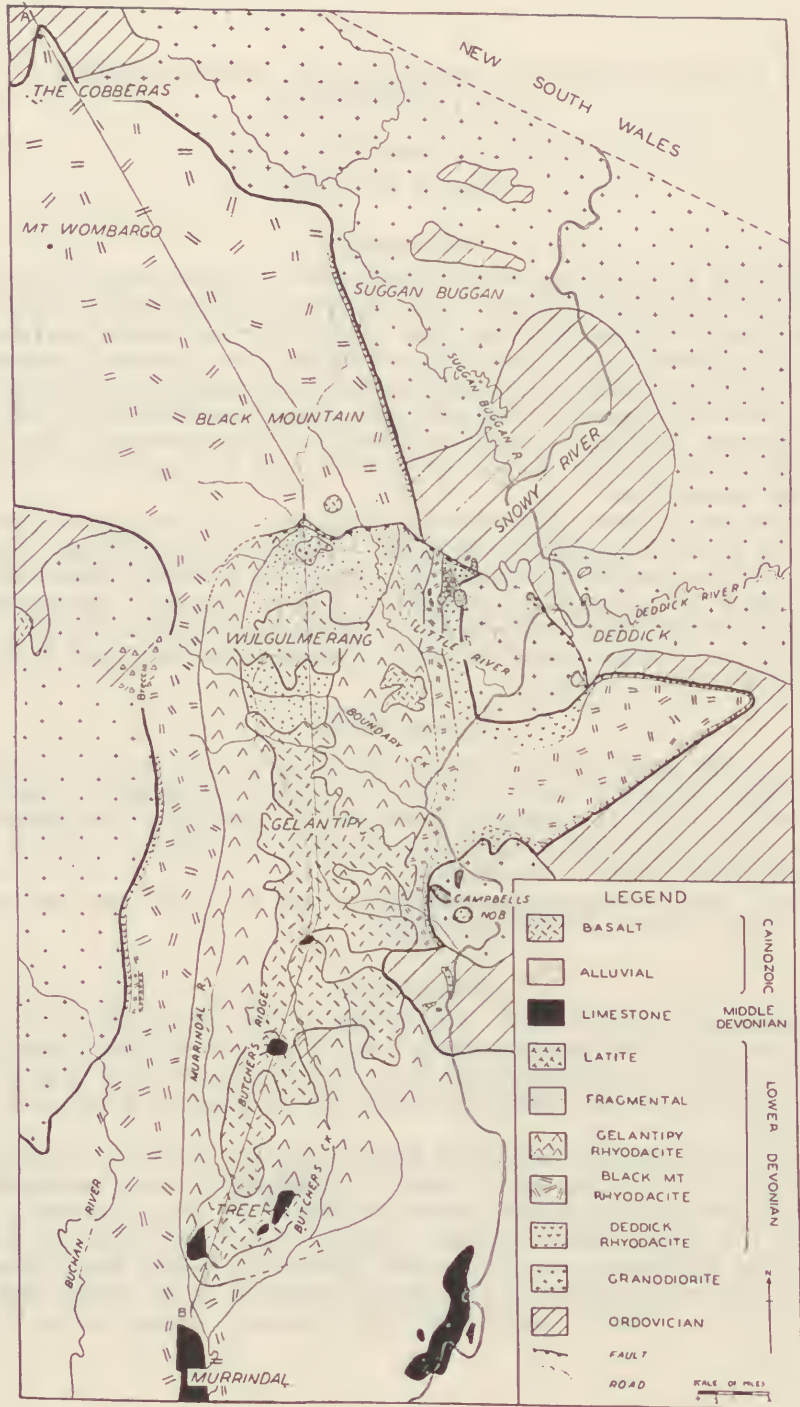


FIG. 1.

River Gorges. These commonly have walls over 2,000 ft. sheer, and furnish magnificent scenery.

Uplift of the peneplain probably took place in the Pliocene, following extrusion of basalt. The pre-basaltic peneplain is well developed around Wulgulmerang, Deddick, and farther north, and had suffered little dissection at the time the basalt was extruded. However, dissection of the pre-basaltic surface becomes more marked as one proceeds southwards, local relief at Gelantipy being of the order of 500 ft.

General Geology

UPPER ORDOVICIAN

Sediments of this age are widespread. The largest exposures occur to the east of the Snowy River and south of the Deddick River, where Upper Ordovician sediments either outcrop or underlie the volcanics. Another large exposure occurs along the Snowy River north of McKellop's Crossing. Other occurrences are near The Cobberas and along the Buchan River west of Wulgulmerang.

The sediments consist of sandstones, greywackes, mudstones, shales and slates which are sometimes carbonaceous. They have been folded and subsequently invaded by intrusions of granite rocks mainly granodiorites, giving rise to contact aureoles of low to medium grade hornfels.

GRANITIC ROCKS

Large exposures of granitic rocks occur in the north of the area and also along the Buchan River. These outcrops are probably continuous beneath the Snowy River Volcanics and form part of the Corryong Batholith (Edwards and Easton 1937) and are also to be correlated with the "grey granites and granodiorites" of Crohn (1949).

Petrological examination has been confined to the rocks of the Deddick district, and it has been shown that they vary between granite and granodiorites in composition, with all gradations between the two. Mostly, however, those with granodioritic or adamellitic composition appear to predominate. An interesting feature of the rock is the common occurrence of cordierite in crystals up to 5 mm. across.

Wherever observed, the granitic rocks are intensely shattered by tectonic movements. The intrusions are broken into small blocks by closely spaced joints and fractures. Slickensides are abundant. No gneissic textures are developed, however. It was shown in the previous paper that this widespread shattering was probably caused by the Tabberabberan Orogeny which folded the overlying Snowy River Volcanics and Buchan Limestones. It was further suggested that the mechanism of folding involved large net vertical movements of the granodiorite by means of a giant fault-folding effect, accompanied by the development of normal anticlines and synclines in the overlying volcanics and limestones.

The granodiorite intrudes Upper Ordovician sediments and underlies unconformably the Snowy River Volcanics of Lower Devonian age. In view of the considerable length of time required to expose the batholith by erosion, prior to the extrusion of volcanics, it seems likely that the granitic rocks are of Silurian age.

LOWER DEVONIAN

A large part of the area to the west of the Snowy River is occupied by the Snowy River Volcanics, which consist of extrusive rhyodacites, latites, and fragmental rocks. Howitt (1876) showed that they overlie the granodiorite and Ordovician sediments unconformably and underlie conformably the Buchan Limestones

of Middle Devonian age. Accordingly he suggested that the Snowy River Volcanics were of Lower Devonian age. Subsequent palaeontological work has established that the basal members of the Buchan Limestones belong to a horizon low in the Middle Devonian and hence Howitt's estimate would appear to be correct. Indeed, in view of the great thickness of the volcanics and the frequent interruptions in the vulcanism indicated by numerous beds of intercalated sediments it would appear that the formation of the Snowy River Volcanics must have occupied a considerable period of time. Perhaps, therefore, some of the early flows may be of Upper Silurian age.

At Deddick, a sequence of members of the Snowy River Volcanics has been determined. For the present purpose, a somewhat simplified sequence will be used, involving only the most important members. Accordingly the Snowy River Volcanics may be subdivided thus.

Latite	
Fragmental Rocks	{ Wulgulmerang Tuffs
	{ Boundary Creek Conglomerates
Gelantipy Rhyodacite	
Black Mountain Rhyodacite	
Deddick Rhyodacite	

The petrology of these rocks has already been described and there seems little point in repeating the descriptions. It may be noted, however, that the three rhyodacites are very similar chemically. All three are quartz rich rhyodacites which have suffered extensive secondary alteration—mainly albitization. They are to be differentiated and recognized according to their textural features, both microscopic and macroscopic. A summary of these in tabular fashion appears in the earlier paper.

Deddick Rhyodacites

These constitute the basal members of the Snowy River Volcanics. They are widespread in the Deddick-Wulgulmerang area and attain their maximum thickness of about 3,100 ft. in the Little River district, south of the Turnback Fault. The flows thin out in all directions outwards from Little River. To the east, in the Deddick area, the thicknesses range from 200 to 1,000 ft., whilst northwards towards Suggan Buggan the total thickness is only 200 ft. Near the Buchan River west of Butcher's Ridge a thickness of about 200 ft. of Deddick Rhyodacite outcrops between the granodiorite and the overlying Black Mountain Rhyodacite. There are two varieties of Deddick Rhyodacite—fine-grained and porphyritic. The latter are found only in the Little River and Deddick areas. Numerous interbedded flows of these types occur at Little River together with intercalated lenses of sedimentary rocks mainly conglomerates.

The Deddick Rhyodacite is probably continuous at the base of the Snowy River Volcanics over most of the area. When it is not found at the contact of the volcanics and basement work the reason is usually faulting, as at Seldom Seen and Wheeler's Creek.

Black Mountain Rhyodacite

Overlying the Deddick Rhyodacite is a flow of great thickness and extent which has been called the Black Mountain Rhyodacite. This is a coarsely porphyritic rhyodacite, densely packed with phenocrysts, and varying between red and black in colour. It attains a thickness of 2,500 ft. in the Little River Gorge and this thickness is probably exceeded along the Buchan River Divide. The whole

of the plateau north of Wulgulmerang, stretching to The Cobberas, is composed of this flow (apart from small occurrences of fragmental rocks near The Cobberas, Black Mountain and Omeo Hill). To the south, it outcrops in two parallel belts forming the limbs of a syncline. One limb outcrops in the range stretching southwards from Mt. Wombargo—Mt. Statham—Mt. Murrindal, whilst the other limb can be traced southwards past Campbell's Nob. It has not been located south of Talicard, however, since it probably outcrops farther to the east in unmapped and inaccessible country. However, this limb is again picked up a couple of miles north of Murrindal where it underlies the limestone.

On the east side of the Snowy River the whole plateau from Deddick in the west to Accommodation Creek in the east, and southwards to Campbell's Nob, is of Black Mountain Rhyodacite. Opposite Butcher's Ridge, on the Buchan River Divide, a flow of latite a few hundred feet thick occurs intercalated with the Black Mountain Rhyodacite not far from the base. Farther south between Murrindal and Buchan, flows of latite become more common, but still appear to be associated with the Black Mountain Rhyodacite (Gaskin: personal communication).

Gelantipy Rhyodacite

The flow which overlies the Black Mountain Rhyodacite is also of great thickness and extent. In the Little River Gorge it is about 2,700 ft. thick. It maintains and probably increases this thickness towards the south. However, it is not found in the northern part of this area, ending abruptly at the Turnback Fault. The significance of this structure was discussed in the previous paper.

At Wulgulmerang the Gelantipy Rhyodacite outcrops in two parallel bands striking north-south; one near the Buchan Divide and one in the Little River-Farm area. These outcrops dip inwards and form a synclinal structure. Towards the south the outcrops converge at Gelantipy, thus forming a basin-shaped structure open at the northern end. It then extends continuously southwards occupying the core of a syncline to a locality between W-tree and Murrindal, where it dies out. Intercalated in the Gelantipy Rhyodacite beds of fragmental material, mainly tuffs, together with some conglomerates, are found. Howitt (1878) has described some sandstones and arkoses occurring near the top of the Gelantipy Rhyodacite at Butcher's Creek. These intercalated beds of fragmental rocks are usually only of local importance and their extent is generally very limited.

Petrologically the Gelantipy Rhyodacite is very similar to the Black Mountain Rhyodacite. The phenocrysts, however, are smaller, sparser, and more euhedral in form. Unlike the Black Mountain Rhyodacite, its appearance is very easily altered by weathering which gives rise to products of the most varied textures and colours. This often makes it difficult to recognize and identify hand specimens without considerable experience.

Fragmental Rocks

In the Deddick district, fragmental rocks occur at several horizons interbedded with the extrusive members. The only place where they are really well developed, however, is in the Wulgulmerang area, where conglomerates overlain by tuffs reach a thickness of 2,000 ft. They overlie the Gelantipy Rhyodacites and occupy a basin-shaped structure, being cut off to the north by the Turnback Fault, and dying out towards the south at Gelantipy. The conglomerates are formed almost exclusively of partly rounded rhyodacite pebbles. Most of the pebbles are of Gelantipy Rhyodacite. They have been called "Boundary Creek Conglomerates". The overlying tuffs have been designated the "Wulgulmerang Tuffs".

Near the base of the Snowy River Volcanics, interbedded mainly with Deddick Rhyodacite, several beds of conglomerate together with a small amount of tuffaceous mudstones and sandstones occur. The beds are usually less than 50 ft. thick. However, the pebbles and detritus are almost completely derived from Ordovician sandstones, greywackes and shales. Similar rocks have been described by Howitt (1878) from Butcher's Creek.

Latites

A flow of latite is the youngest member of the Snowy River Volcanics. It overlies the tuffs near the Turnback Fault, and occupies about one square mile. Two smaller and thinner flows occur at lower horizons in the Snowy River Volcanics.

As was mentioned earlier, a flow of latite occurs west of Butcher's Ridge near the base of the Black Mountain Rhyodacite. Latites related in time to this flow appear to become more common towards the south, between Murrindal and Buchan.

MIDDLE DEVONIAN

Howitt (1876, 1878) showed that the Buchan Limestones which were placed in the Middle Devonian on palaeontological grounds conformably overlay the "Snowy River Porphyries" in several places. At some places, a transitional series of calcareous tuffs occurred between the "porphyries" and the limestone, whilst at others, limestone rested on porphyry without any transitional beds. Howitt also discovered several instances where the limestone-porphyry contacts were faults.

Subsequently Gaskin (unpublished) has mapped the Snowy River Volcanics between Buchan and Murrindal. He has established that the limestones occupy the core of a large N-S striking synclinal fold in the volcanics. These relationships are not affected by the fact that limestone-volcanic contacts are sometimes faulted. The faults are usually local, and limited in extent.

North of Murrindal, five small outliers of limestone occur between W-Tree and Gelantipy. All five outcrops lie on the main synclinal axis stretching between Murrindal and Wulgulmerang; i.e. their geological relationships are similar to those of the Buchan Limestones. The dips of these outliers are low, and as far as could be ascertained, conform to those of the underlying volcanics. There can be little doubt that they represent the remnants of a formerly extensive limestone formation which conformably overlay the Snowy River Volcanics. Other outcrops also occur farther north at Native Dog Creek, The Pilot, and Limestone Creek.

The two northernmost outcrops rest directly upon Gelantipy Rhyodacite, but the outcrops near W-Tree are separated from the Gelantipy Rhyodacite by beds of fragmental rocks. Howitt (1878) has suggested that the limestones at W-Tree owe their position to faulting, but field evidence of this is lacking. In view of their general field relationships it seems most unlikely.

STRUCTURAL RELATIONSHIPS

The mechanics of extrusion of the volcanics were discussed at length in the previous paper, and the matter will not be further pursued.

In that paper it was shown that the Snowy River Volcanics had been folded into north-south synclines and anticlines during the Tabberabberan Orogeny.

The sections and maps accompanying that paper display the structural relationships of that area. In Fig. 1 it is shown that the syncline occurring in the Snowy River Volcanics at Wulgulmerang continues southwards until it meets the syncline found by Gaskin in the Murrindal-Buchan district. It is suggested that a serviceable

name for this structure would be the "Murrindal Syncline". The limestones, as was mentioned earlier, lie folded in along the synclinal axis.

At Deddick, ten miles to the east of Wulgulmerang, a second synclinal structure striking approximately north-south occurs, in the rhyodacites. If the syncline is continued along the strike parallel to the Murrindal Syncline, it coincides with a long narrow infolded strip of limestone extending from the Snowy River east of W-Tree past Jackson's Crossing, and with interruptions to the "Basin" ten miles north-east of Buchan. At the Basin, Gaskin (personal communication) has established that the limestones also occur in the core of a syncline in the Snowy River Volcanics. It would therefore appear that a second major syncline exists, stretching from Deddick to the Buchan district, parallel to, and east of the Murrindal Syncline.

Ten miles to the west of the Murrindal Syncline, outcrops of limestone occur along an approximate north-south strike, namely at Limestone Creek, Native Dog Creek and Gellingall. In addition, between the two last-mentioned localities, Mr. Keith Rogers, a local resident who is a keen and reliable observer of geological phenomena, reports the existence of two hitherto unrecorded outcrops of limestone. Both lie approximately on the same strike. One patch is on the east side of the Buchan River opposite Seldom Seen Lookout, and the other is several miles to the south. It would therefore appear that a third north-south striking major synclinal structure is indicated.

Thus a broad picture of the structural geology of this part of East Gippsland begins to emerge. During the Lower Devonian epoch, great volumes of mainly acidic extrusives were erupted, covering possibly as much as two or three thousand square miles. The thickness of the volcanics reached 10,000 ft. in places. Regional subsidence then occurred during the Middle Devonian accompanied by deposition of a few thousand feet of marine limestone conformably overlying the volcanics. Finally, during Epi-Middle Devonian times, during the Tabberabberan Orogeny, the volcanics were folded into three major synclines separated by anticlines, all with an approximate north-south strike. The folds are probably continuous from the New South Wales border to Nowa Nowa. The more competent rhyodacites formed broad open folds whereas the limestones and tuffs were disharmonically folded within the major folds.

A long period of erosion then occurred during which most of the limestones were removed. The remaining limestones occur as isolated outliers in the cores of the synclines.

EPI-MIDDLE DEVONIAN

A swarm of lamprophyre dykes associated with silver-lead mineralization occur widely throughout the area. Mostly they are found in the basement granodiorite, as at Deddick and Campbell's Nob, but also rarely in the Snowy River Volcanics and overlying limestones (Howitt, 1878). They have been fully described in the earlier paper. The dykes are later than the Middle Devonian limestones but have been sheared and fractured, probably during later stages of the Tabberabberan Orogeny. The area dealt with appears to constitute a mineral province characterized by silver-lead mineralization associated with these dykes.

CAINOZOIC

A capping of Newer Basalt of probable Pliocene age (Hills, 1938) occurs on the Gelantipy Plateau between Wulgulmerang and W-Tree. The basalts appear to average about 200 ft. in thickness although locally they may reach 500 ft.

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